Nenana Ridge Research Prescribed Burns

Quantifying the Effects of Fuels Reduction Treatments on Fire Behavior and Post-fire Vegetation Dynamics in Alaska Black Spruce

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Skip Theisen	BLM Fairbanks District Office
Dale Haggstrom	State Dept of Fish and Game
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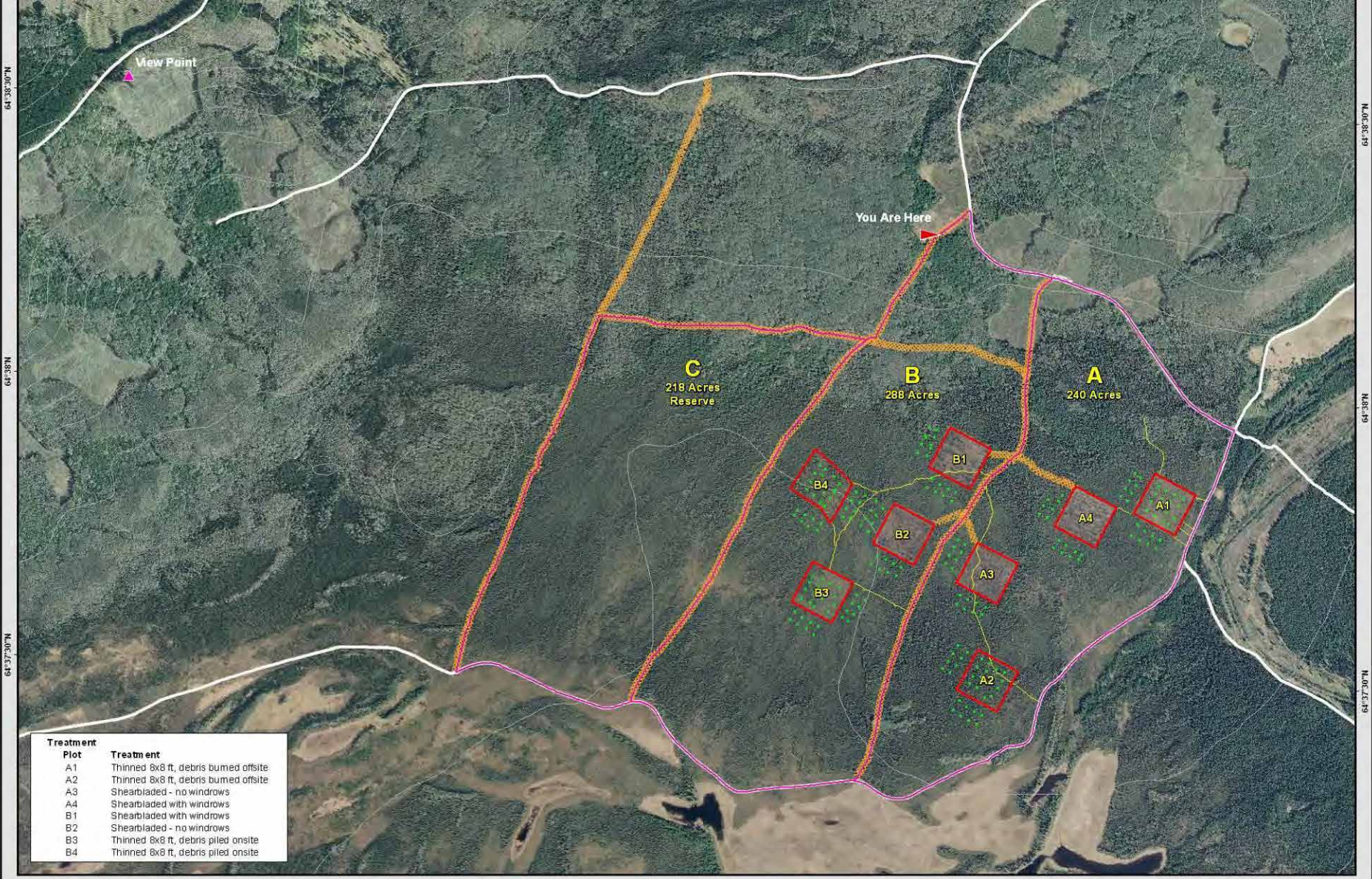
Eric Miller	BLM Alaska Fire Service



Treatment Plot	Treatment
A1	Thinned 8x8 ft, debris burned offsite
A2	Thinned 8x8 ft, debris burned offsite
A3	Shearbladed - no windrows
A4	Shearbladed with windrows
B1	Shearbladed with windrows
B2	Shearbladed - no windrows
B3	Thinned 8x8 ft, debris piled onsite
B4	Thinned 8x8 ft, debris piled onsite

Dozerlines
Foot Trails
Burn Units
Treatment Plots
Research Plots
View Point
You Are Here

ATTENTION: This is an active fire effects research area. Please do not disturb. For more information, contact the State Division of Forestry at 451-2600.

N W E S

0 125 250 Meters
0 500 1,000 Feet
0 0.125 0.25 Kilometers
0 0.1 0.2 Miles


6 7 2006 15

Pre- and Post-burn Vegetation Sampling

- Understory species composition and density
- Tree seedling density
- Coarse woody debris
- Fine woody debris
- Overstory tree composition, density, basal area and canopy cover
- Stand age

Forest Floor Consumption During the Nenana Ridge Prescribed Fire in Alaska

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Why are we concerned about the consumption of the Boreal forest floor?

- Deep layers
- Large pool of biomass (+100 tons/acre)
- Often drives fire behavior
- Potential for large fire effects
  - Smoke emissions (1 ton of PM2.5/acre)
  - Regional haze
  - Permafrost melting
  - Erosion
  - Plant succession

Forest Floor Consumption and Smoke Characterization Project

Objectives

- Quantify fuel consumption of the forest floor in the treated and control plots
- Compare forest floor consumption within the treated versus non-treated plot sites.
- Use fuel consumption data to validate current forest floor consumption model in Consume.

Pre-fire Inventory Methods

- Standard set of protocols to measure forest floor depth, reduction, and consumption.
  - 16 permanent plots for each of the control and treated sites
  - 16 forest floor pins per plot
  - Independent variables measured including moisture content, weather, and density

Forest Floor Moisture Content & Weather

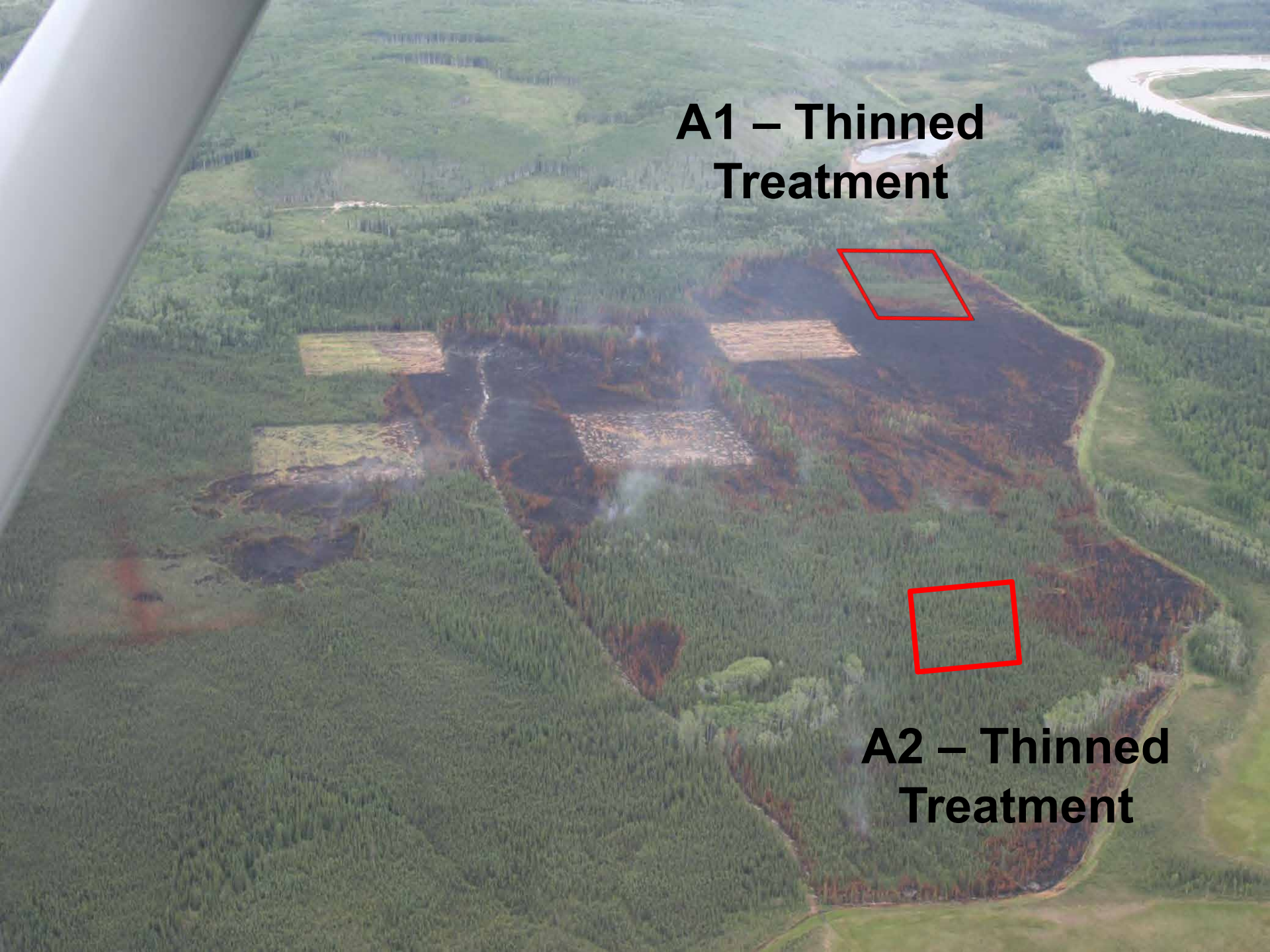
Live Moss

Dead Moss

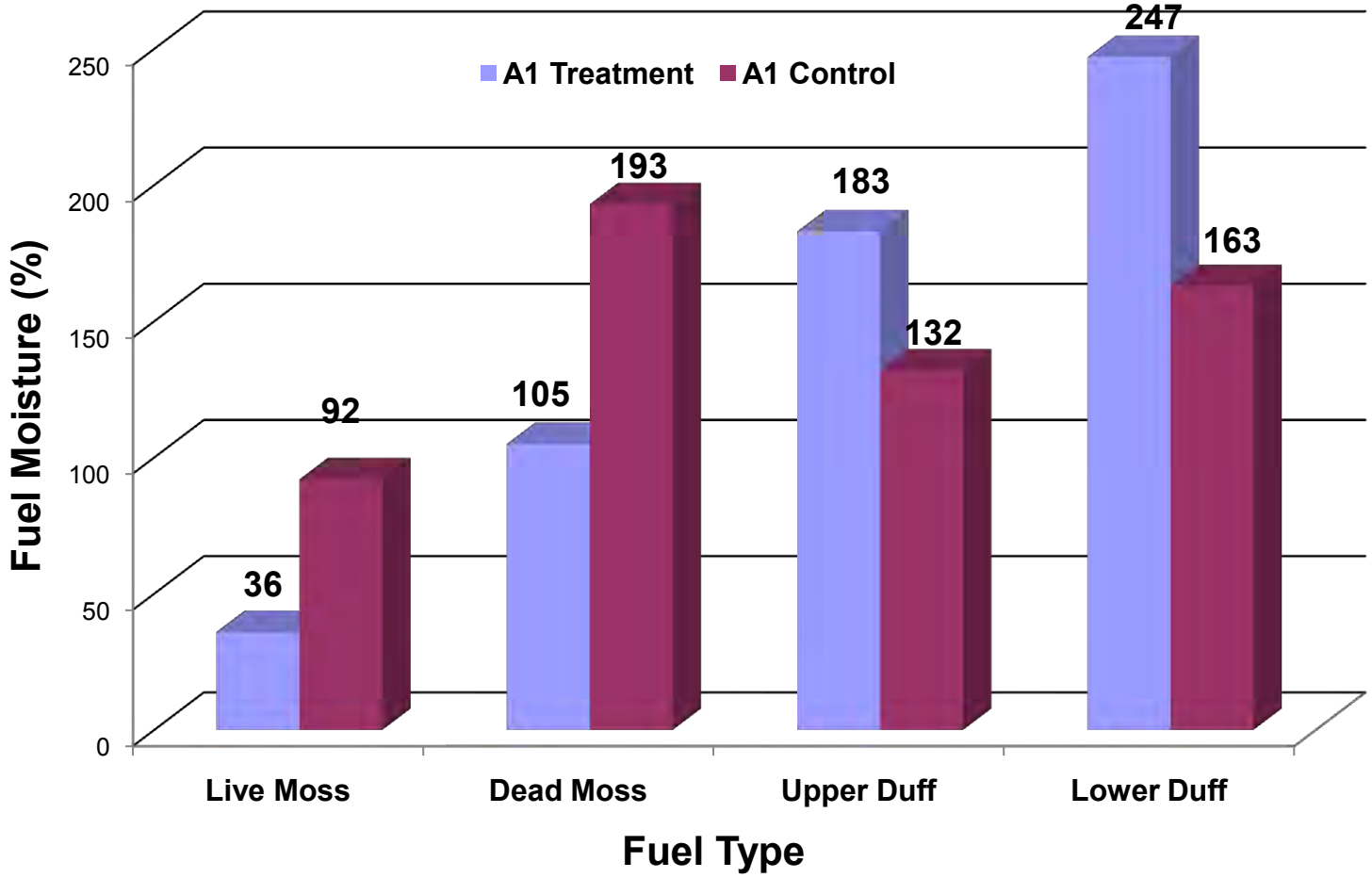
Upper Duff

Lower Duff

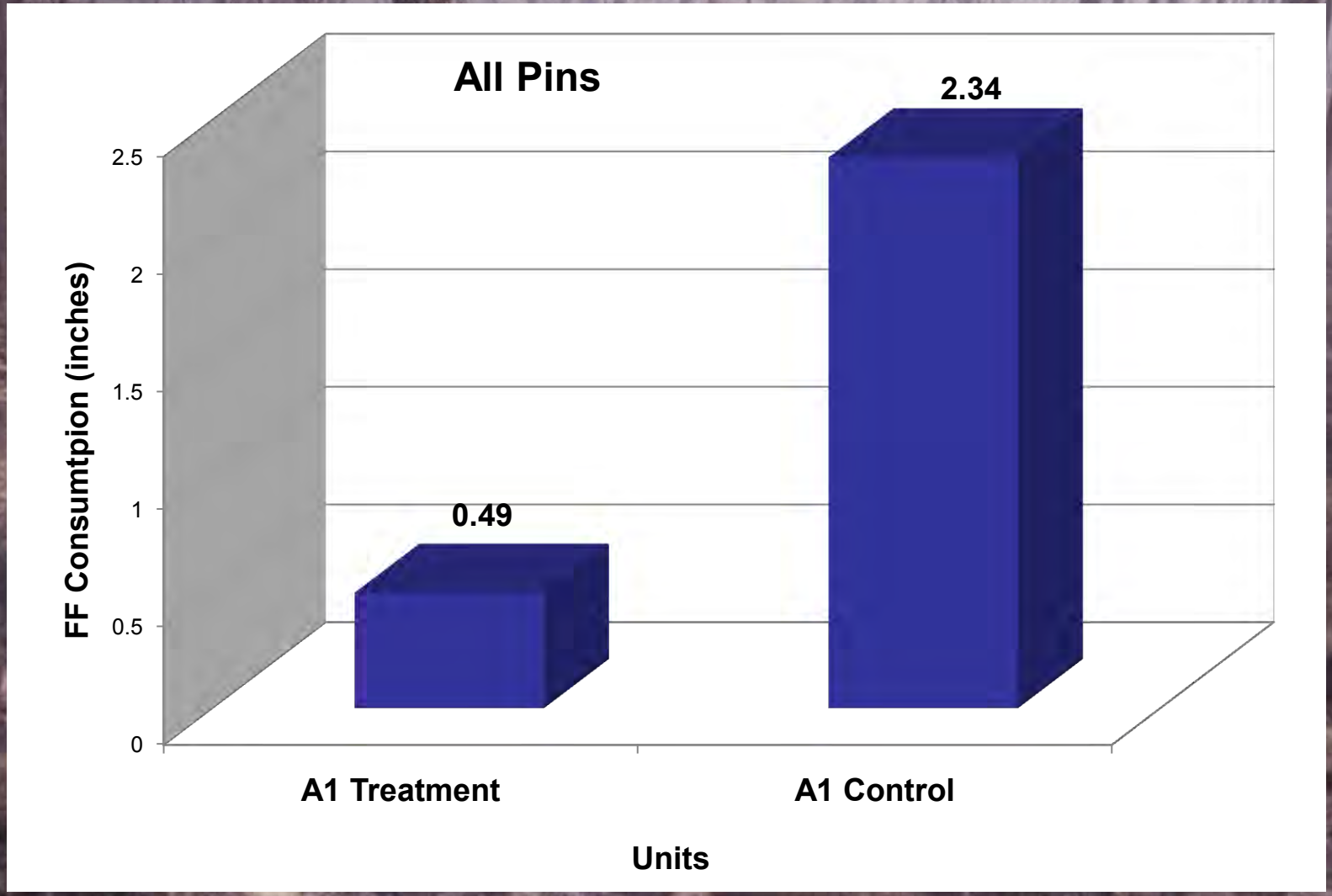
Mineral Soil


A1 – Thinned Treatment
A2 – Thinned Treatment

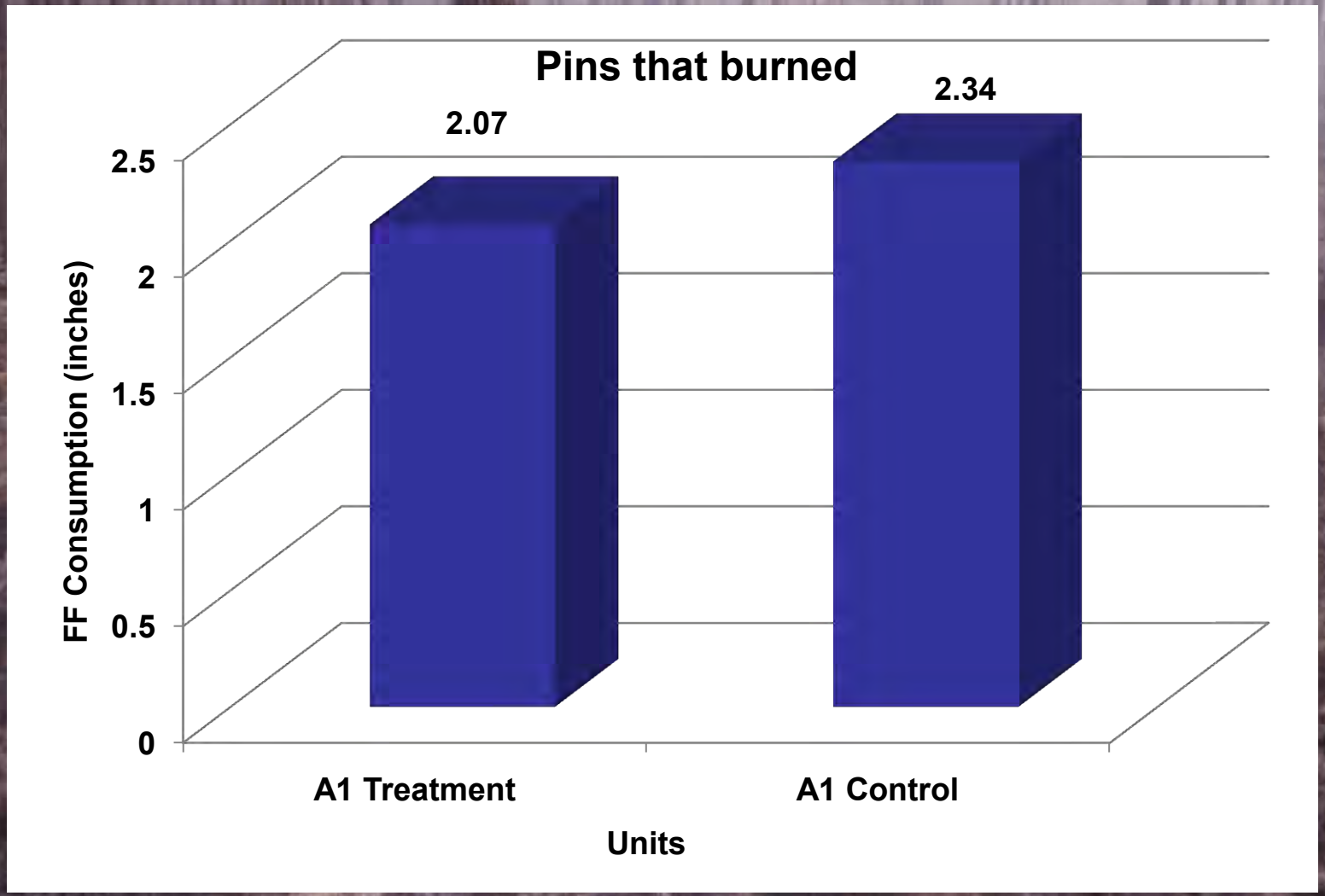
Post Fire Inventory Results

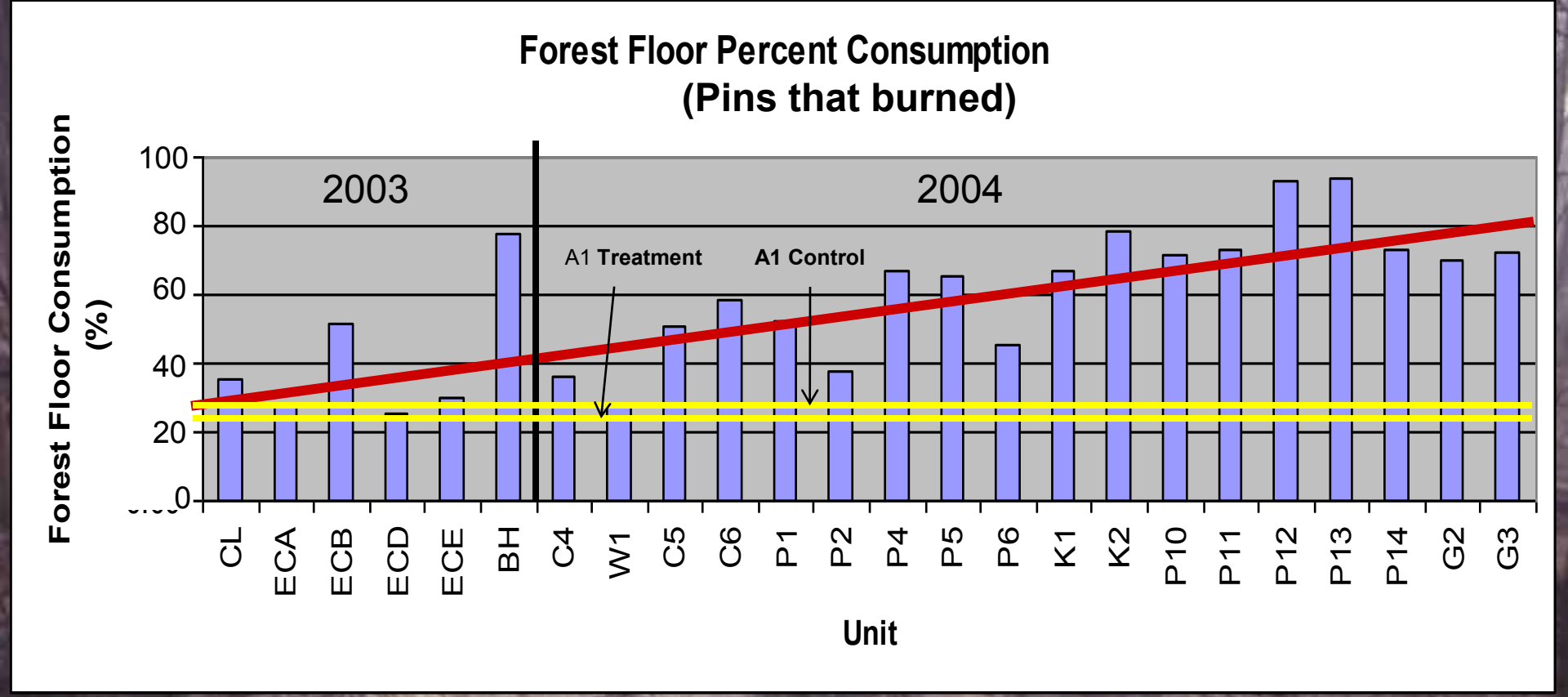


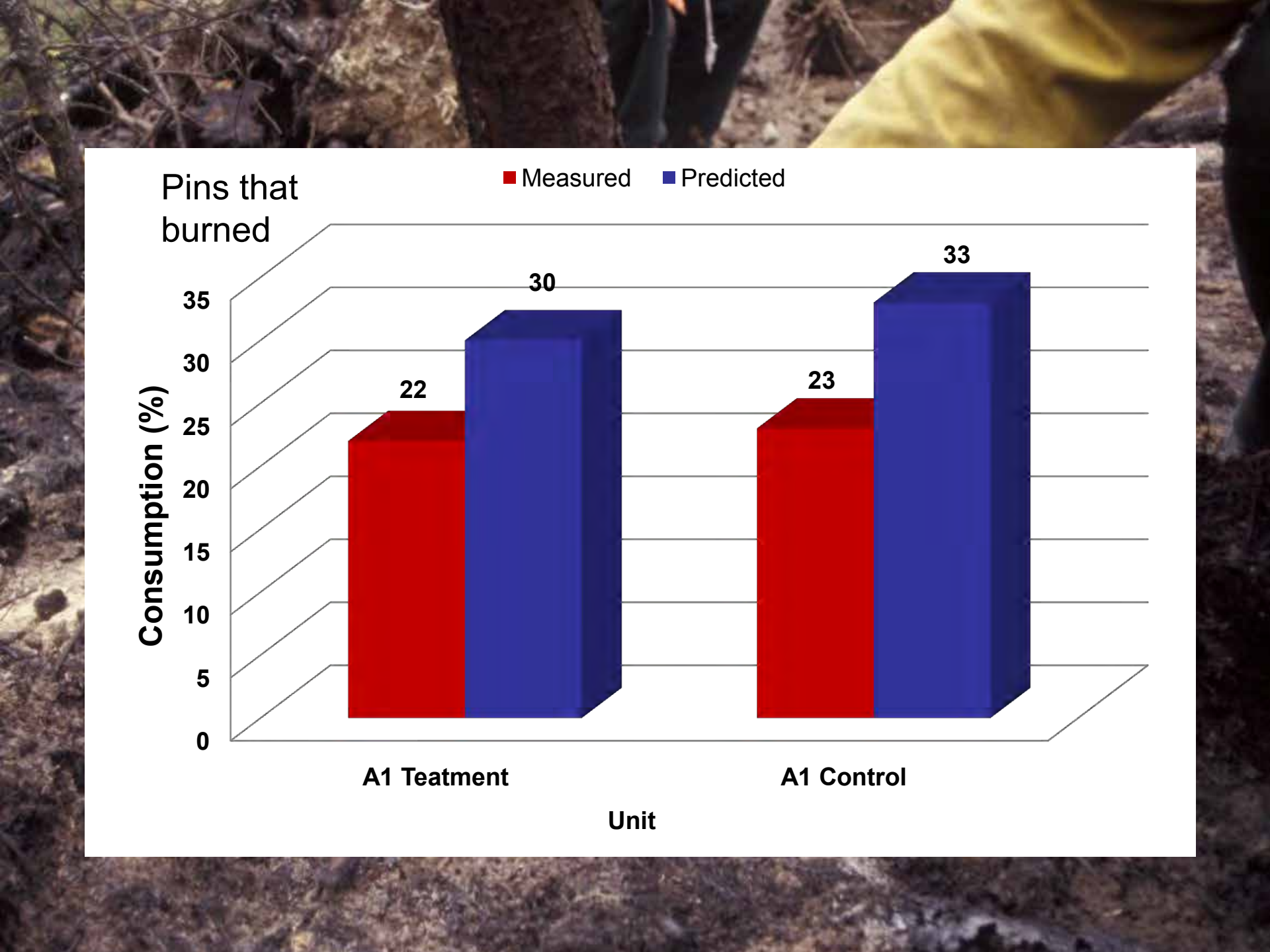
Forest Floor Reduction



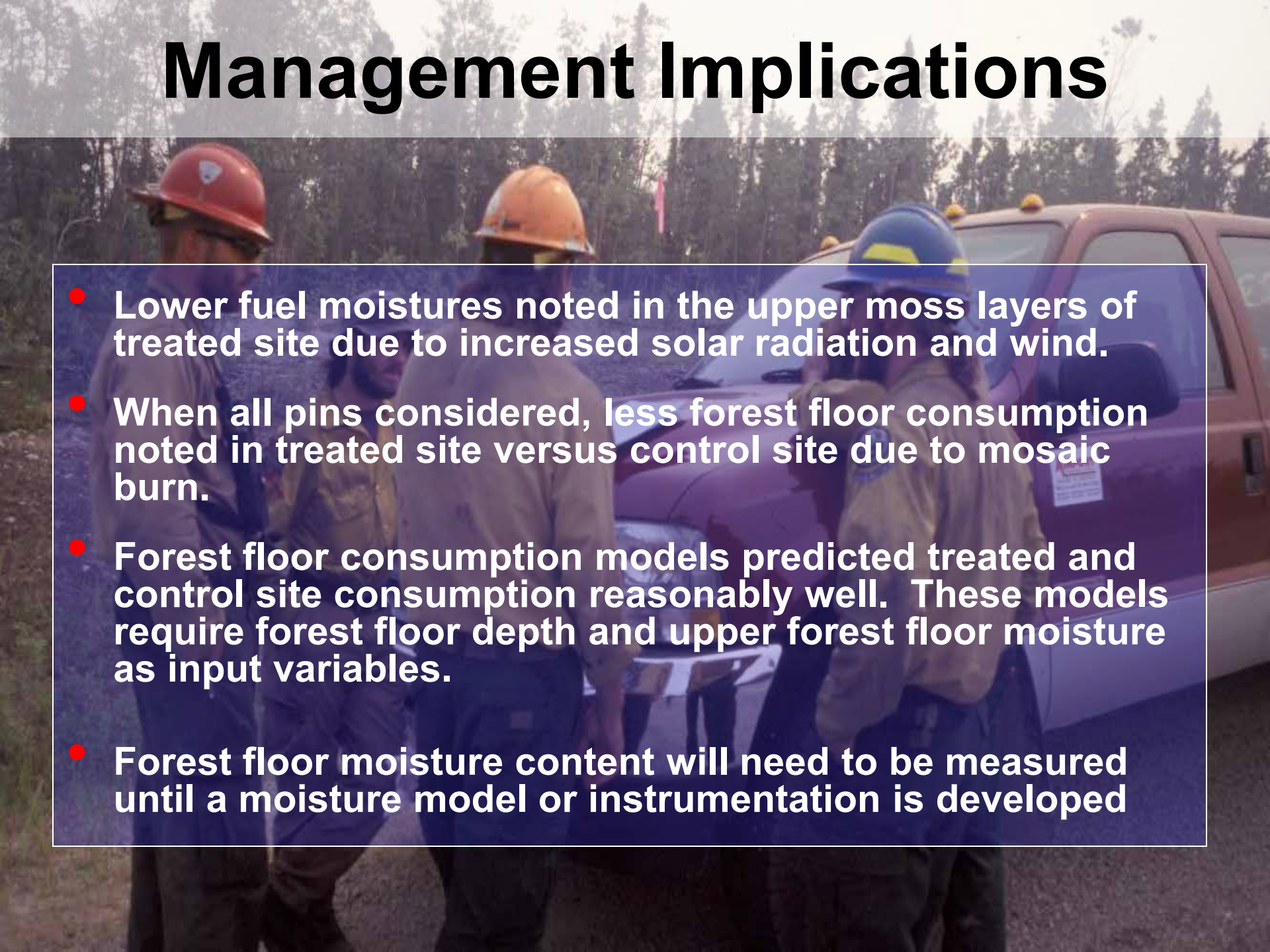
Forest Floor Reduction




Forest Floor Percent Consumption
(Pins that burned)
Forest Floor Consumption (%)
100
80
60
40
20
0
2003
2004
A1 Treatment
A1 Control
CL
ECA
ECB
ECD
ECE
BH
C4
W1
C5
C6
P1
P2
P4
P5
P6
K1
K2
P10
P11
P12
P13
P14
G2
G3
Unit


Pins that burned
Measured
Predicted
Consumption (%)
35
30
25
20
15
10
5
0
22
30
23
33
A1 Teatment
A1 Control
Unit

Management Implications



- Lower fuel moistures noted in the upper moss layers of treated site due to increased solar radiation and wind.
- When all pins considered, less forest floor consumption noted in treated site versus control site due to mosaic burn.
- Forest floor consumption models predicted treated and control site consumption reasonably well. These models require forest floor depth and upper forest floor moisture as input variables.
- Forest floor moisture content will need to be measured until a moisture model or instrumentation is developed

Fire Behavior on Nenana Ridge

Objective:

Characterize effect of treatments on Fire Behavior

Bret Butler

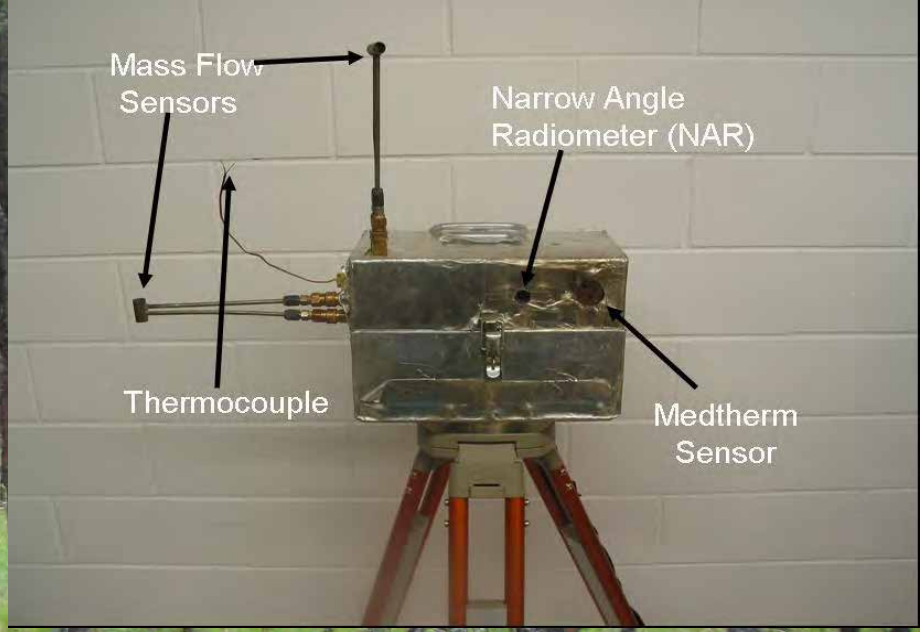
US Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory

USFS, Fire Behavior Research

Sensors

Fire Behavior Packages

- Air/gas temperature
- Flame emissive power
- Incident total heat
- Incident radiant heat
- Air/gas vertical flow
- Air/gas horizontal flow



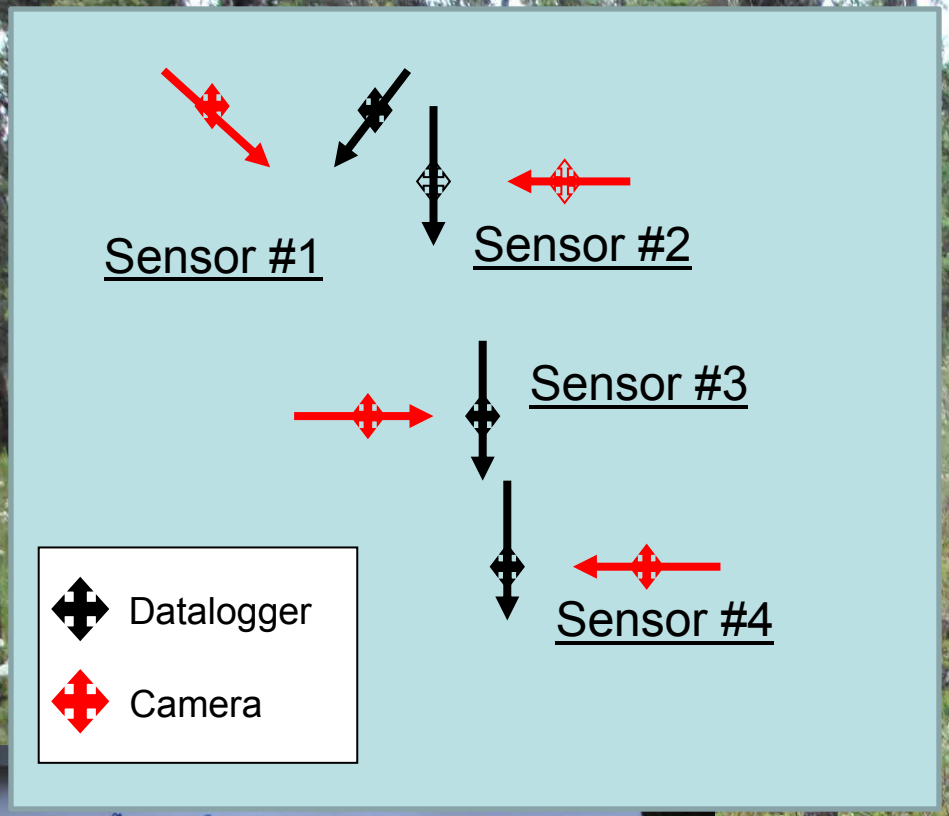
USDA Forest Service, Fire Behavior Research

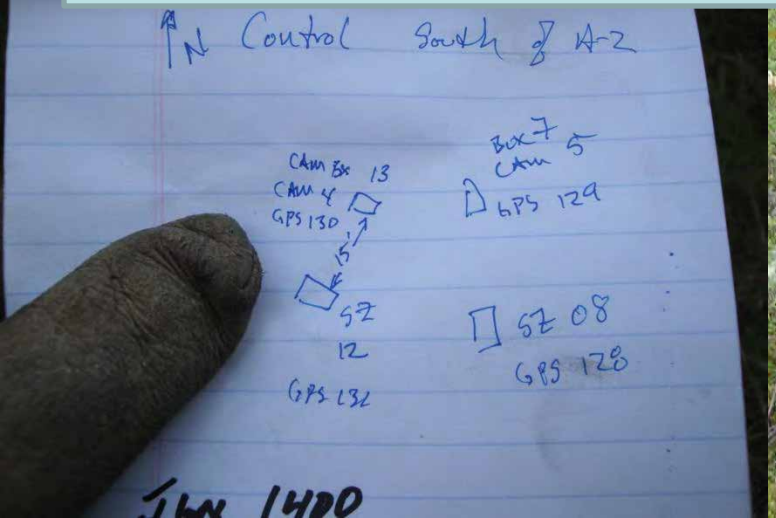
Cameras

Fire proof box

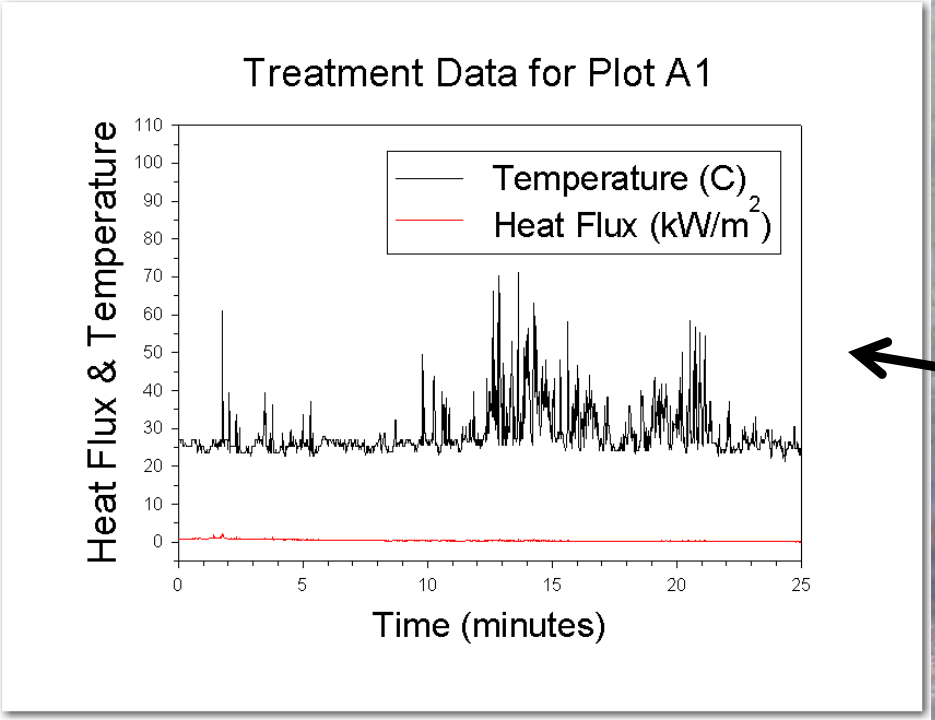
Manual or Automatic Trigger (from logger)

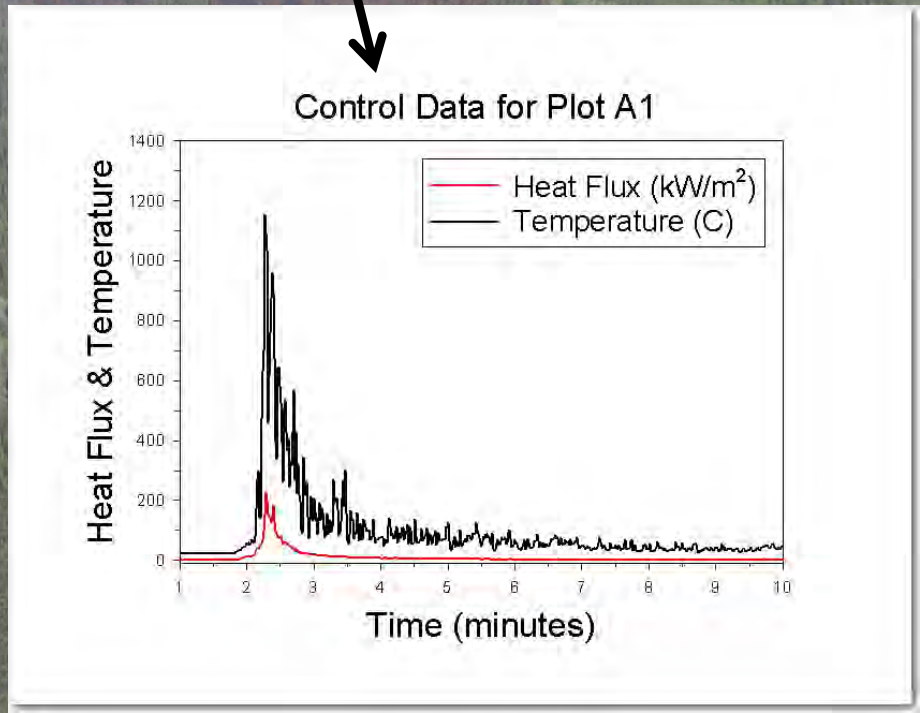
Typical Deployment Layout

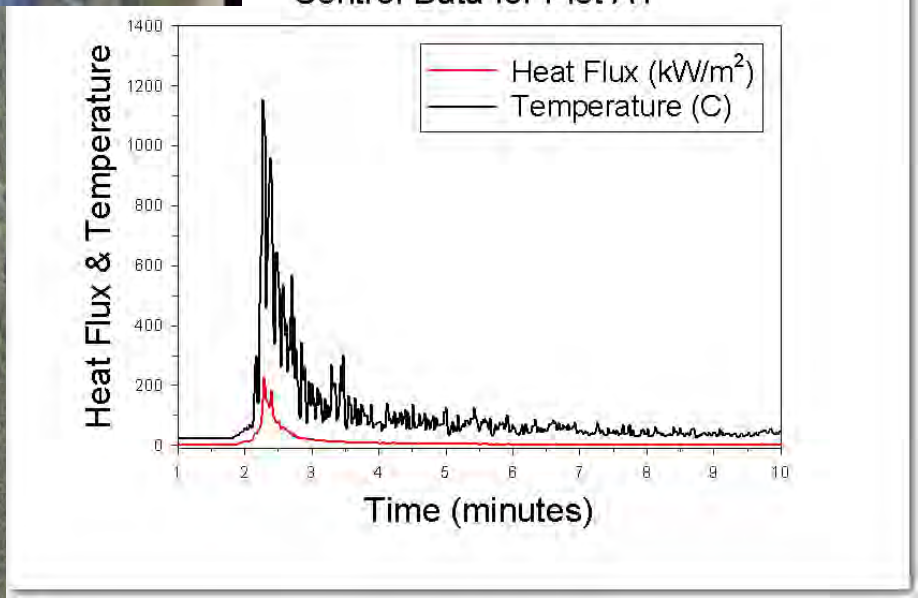


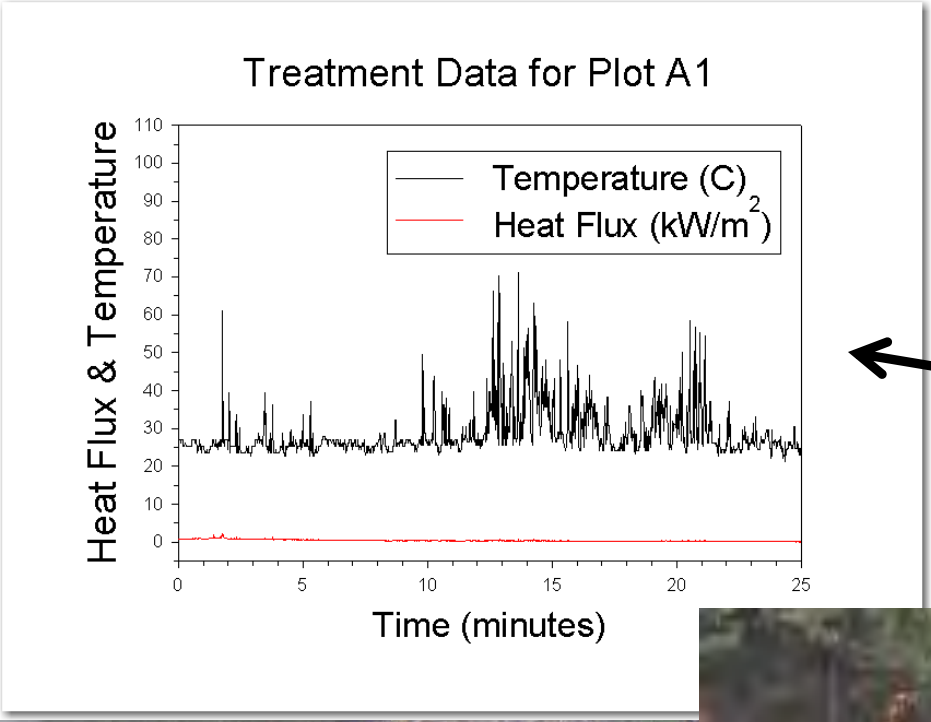


GPS position
Height of Sensors
Camera Height
Fuels
Compass Orientation
etc

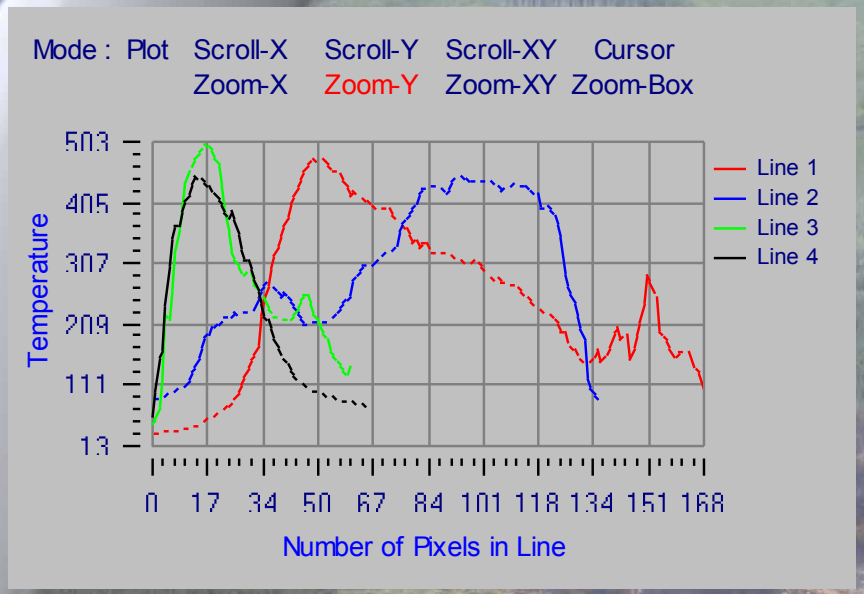

Treatment Data for Plot A1
Heat Flux & Temperature
Temperature (C)
Heat Flux (kW/m2)
Time (minutes)

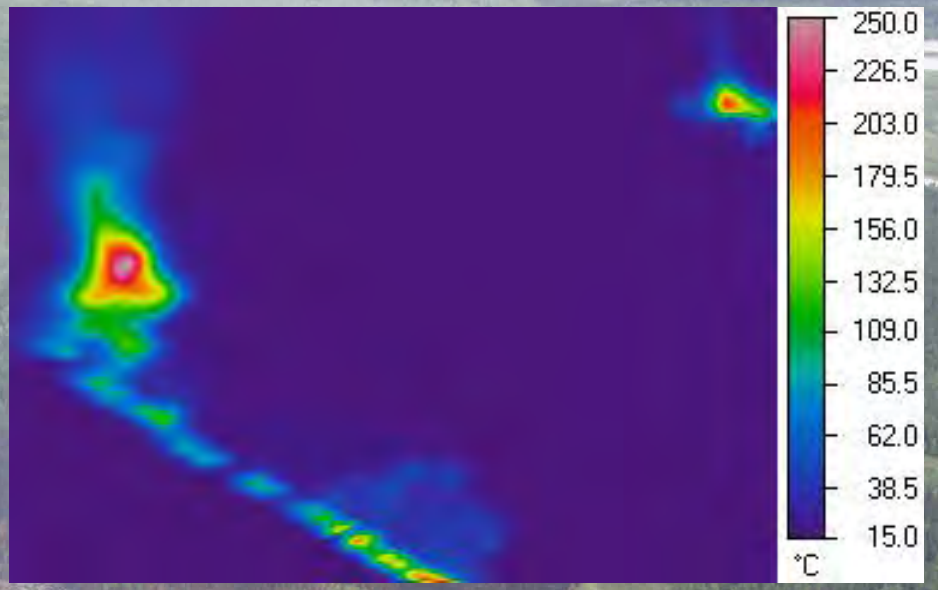

Control Data for Plot A1
Heat Flux & Temperature
Heat Flux (kW/m2)
Temperature (C)
Time (minutes)

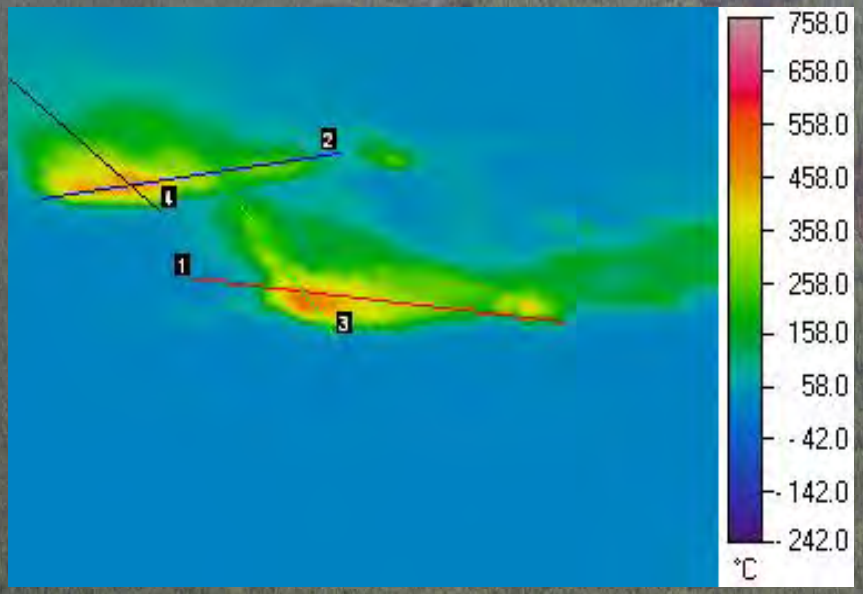

Control Data for Plot A1
Heat Flux (kW/m2)
Temperature (C)
Heat Flux & Temperature
Time (minutes)
0
200
400
600
800
1000
1200
1400
1
2
3
4
5
6
7
8
9
10

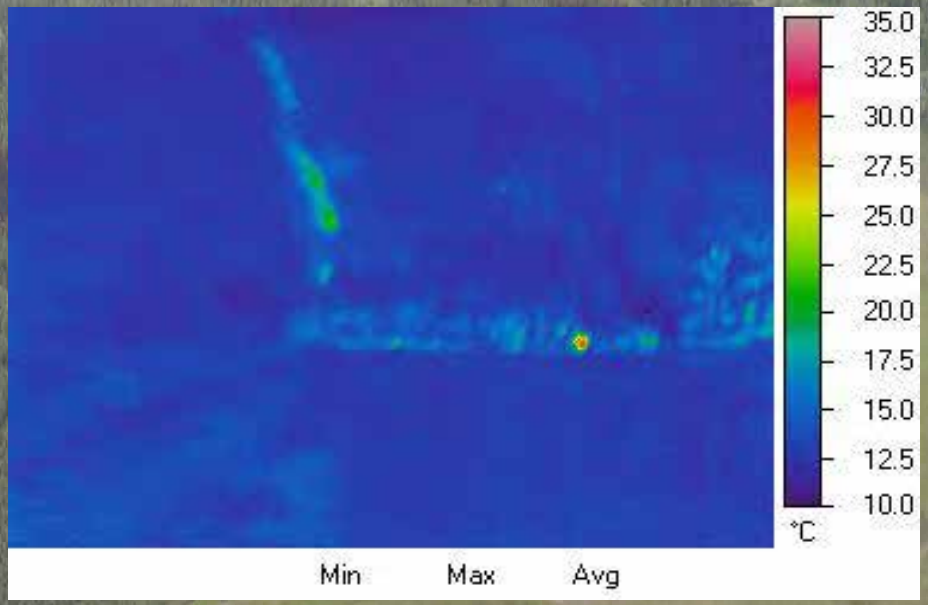

Treatment Data for Plot A1
Heat Flux & Temperature
Temperature (C)
Heat Flux (kW/m2)
Time (minutes)
0
10
20
30
40
50
60
70
80
90
100
110
0
5
10
15
20
25


Unit: A-1 Thin
Treatment


Mode : Plot Scroll-X Scroll-Y Scroll-XY Cursor
Zoom-X Zoom-Y Zoom-XY Zoom-Box
503
405
307
209
111
13
Temperature
0 17 34 50 67 84 101 118 134 151 168
Number of Pixels in Line
Line 1
Line 2
Line 3
Line 4


250.0
226.5
203.0
179.5
156.0
132.5
109.0
85.5
62.0
38.5
15.0
°C


2
1
1
3
758.0
658.0
558.0
458.0
358.0
258.0
158.0
58.0
- 42.0
- 142.0
- 242.0
°C


35.0
32.5
30.0
27.5
25.0
22.5
20.0
17.5
15.0
12.5
10.0
°C
Min
Max
Avg

Summary

- Quantified energy release across Unit A.
- Improved measurement methods and instruments
- Demonstrated potential value of IR imagery
  - Rate of Spread
  - Interpreting point measurements across time and space
  - Relating fire behavior to fuels.